

B.Sc. Ist yr Syllabus (Annual Scheme)

PAPER I (Paper Code: BOT 101)

ALGAE, LICHENS AND BRYOPHYTES

UNIT-I

General Characters of algae, thallus organization, variety of habitat, pigments and reserve food material in algae. Classification (Fritsch 1935 & Smith 1955), Types of life cycle. Ultrastructure of *Chlamydomonas*.

UNIT-II

General account and life cycle of Chlorophyceae: *Volvox*, *Hydrodictyon*, *Cladophora*, *Oedogonium* and *Chara*. Xanthophyceae: *Vaucheria* and its systematic position. Bacillariophyceae: General account.

UNIT-III

General account and life cycle of Phaeophyceae: *Ectocarpus*, Rhodophyceae: *Polysiphonia*, Economic importance of algae. Lichens: Important features, structure, habitat, reproduction ecological and economic importance of lichen. Life cycle of *Parmelia*.

UNIT-IV

General characters, habit, habitat and classification of Bryophytes. Morphology and life history of *Riccia*, *Marchantia* and *Anthoceros*. Affinities of bryophytes with algae.

UNIT-V

Morphology and life history of *Sphagnum* and *Polytrichum*. The evolutionary trends of gametophyte and sporophyte in Bryophytes. Economic and biological importance of Bryophytes.

B.Sc. I yr Syllabus (Annual Scheme)

PAPER II (Paper Code: BOT 102)

MYCOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY

UNIT-I

General characters, modes of reproduction, types of life cycle and classification (Alexopoulos 1962 & Mims 1979) of fungi. Important features and life cycle of *Albugo*, *Penicillium* and *Morchella*.

UNIT-II

Important features and life cycle of *Puccinia*, *Ustilago*, *Agaricus* and *Alternaria*. Economic importance of fungi. Mycorrhiza and their symbiotic significance.

UNIT-III

General account, classification, structure and reproduction of bacteria. General account of Cyanobacteria – *Oscillatoria* and *Nostoc*. Gram's staining. Economic importance of bacteria.

UNIT-IV

General account, structure and economic importance of Mycoplasma, viruses and Bacteriophage. Nature, structure, transmission and multiplication of plant virus-TMV.

UNIT-IV

Principles of plant pathology. Causes, symptoms and control of following plant diseases: Green ear disease of Bajra, Loose smut of Wheat, Black rust of Wheat, Citrus canker, Little leaf of Brinjal, Yellow vein mosaic of Bhindi, Powdery mildew of cucurbits.

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PAPER III (Paper Code: BOT 103)

PALAEOBOTANY, PTERIDIOPHYTES AND GYMNOSPERMS

UNIT-I

General characters and classification of pteridophyta. Stele system in pteridophytes. Geological time scale. Types of fossils, process of fossilization. Methods of study of fossils. General account of *Rhynia* and *Williamsonia*.

UNIT-II

Important features and life cycle of *Psilotum*, *Lycopodium* and *Equisetum*.

UNIT-III

Important features and life cycle of *Selaginella* and *Marsilea*. Homospory, heterospory and origin of seed habit. Economic importance of Pteridophytes.

UNIT-IV

General characters, economic importance and classification of Gymnosperms, Occurrence, structure and life cycle of *Cycas*.

UNIT-V

Occurrence, structure and life cycle of *Pinus* and *Ephedra*.

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Practical Paper (Paper Code : BOT 104)

Microscopic preparation and study of the following:

Algae: Chlamydomonas, Volvox, Hydrodictyon, Cladophora, Oedogonium, Chara, Vaucheria, Ectocarpus, and Polysiphonia

Bryophyte: Riccia, Marchantia, Anthoceros, Polytrichum and Sphagnum

Fungi: Albugo, Penicillium, Morchella Puccinia, Ustilago Agaricus, Alternaria.

Microbiology: Bacteria (Gram's staining), Nostoc and Oscillatoria.

Lichens : Study of different type of lichen specimen

Plant pathology: Study of some locally available materials/specimens showing plant diseases caused by Viruses, Mycoplasma, Bacteria and Fungi in field/ laboratory. Yellow vein mosaic of Bhindi, Little leaf of *Solanum melongena* (Brinjal), Citrus canker, Green ear disease of bajra, Rust and Smut of wheat and White rust of crucifers.

Pteridophytes: (Slide preparation and study of following materials)

1. *Psilotum* - External morphology and anatomy (photographs / specimen/model).
2. *Lycopodium* - External morphology, T.S. of stem and L.S. of cone.
3. *Selaginella* - External morphology, T.S. of stem, L.S. of cone, T.S of root and rhizophore
4. *Equisetum* - External morphology, T.S. of stem (internode) and T.S.& L.S of cone.
5. *Marsilea* - External morphology, T.S.of rhizome, petiole, root and sporocarp (Any section - H.L.S. /V.T.S. /V.L.S.).

Gymnosperms:(Material C- Vegetative Part, Material D- Reproductive Part)

1. *Cycas*: External morphology, T.S. of normal root (Permanent slide only),T.S. of coralloid root ,T.S. of rachis and T.S. of leaflet, specimens of male cone and megasporophylls.
2. *Pinus*: External morphology, T.S. of needle, specimens of male and female cones.
3. *Ephedra*: External morphology, T.S. of stem, mounting of male flower and L.S. of female reproductive part.

Palaeobotany:

1. *Rhynia*, and *Williamsonia* (Slides/Photograph/Specimen).

B.Sc. II yr Syllabus (Annual Scheme)

PAPER I (Paper Code : BOT 201)

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY

UNIT-I

Herbarium; Tools and Techniques. Important herbaria and botanical gardens of the world and India, Keys: single access and multi-access. Botanical Nomenclature, Principles and Rules, Taxonomic Ranks, Type Concept, Principles of Priority, Cladograms and phenograms Classification of Angiosperms –Natural, Artificial and Phylogenetic- Bentham and Hooker, Engler and Prantl systems of classification upto series.

UNIT-II

Leaf-Types, Aestivation and venation, Inflorescence of flower, Special types of fruits, Signs and letters used in floral formula. Flower characters, flower formula, floral diagram and economic importance of Ranunculaceae, Brassicaceae and Malvaceae.

UNIT-III

Flower characters, flower formula, floral diagram and economic importance of Fabaceae, Cucurbitaceae, Asteraceae, Apocyanaceae, Solanaceae, Liliaceae and Poaceae.

UNIT-IV

Economic Botany with special reference to centre of origin, common name, botanical name, family, plant parts used and economic importance of: Cereals- rice, wheat and maize. Pulses- green gram, chick pea, pigeon pea and soyabean. Fibers – cotton and jute. Oils- groundnut, mustard and coconut. Timbers-shisham, sal and teak. Beverages- Tea and coffee. Rubber, Sugar and Paper manufacturing.

UNIT-V

Economic Botany with special reference to centre of origin, common name, botanical name, family, plant parts used and economic importance of: Spices and Condiments- Curcuma, Cumin, Coriandrum, Fennel, Pepper, Syzygium, Ellataria, Asafoetida, Saffron, Cinnamon. Medicinal uses of following plants with special reference to Rajasthan- *Aloe*, *Commiphora*, *Withania*, *Rawolfia*, *Opium* and *Abrus*. Ethnobotany- Introduction, Methods of Ethnobotanical studies, and knowledge of aboriginals in Rajasthan.

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PAPER II (Paper Code: BOT 202)

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

UNIT-I

Plant anatomy: introduction, tissue and tissue system, classification of meristems, root and shoot apical meristems (RAM and SAM) and theories related to their organization. Simple, complex and secretory tissue.

UNIT-II

Structure of monocot and dicot root, stem and leaf. Cambium – structure, types function and seasonal activity. Periderm. Secondary growth in root and stem, Wood (heartwood and sapwood).

UNIT-III

Anomalous primary and secondary structures in stem and root: Stems- *Bignonia*, *Nyctanthus*, *Boerhaavia*, *Leptadenia*, *Achyranthus*, *Dracaena* Root – *Ficus* & *Tinospora*.

UNIT-IV

Microsporangium, microsporogenesis, structure and development of male gametophyte. Megasporangium, types and development of Ovule. Megasporogenesis, Structure and development of female gametophyte (embryo sac), types of embryo sacs.

UNIT- V

Pollination and fertilization. Endosperm: types and development of monocot and dicot embryo. Polyembryony, apomixis, parthenogenesis and parthenocarpy.

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Paper III (Paper Code : BOT 203)
CYTOLOGY, GENETICS, PLANT BREEDING AND EVOLUTION

UNIT-I

Cell theory, Prokaryotic and eukaryotic cell, Structure and function of cell wall. Plasma membrane, Plastid, Mitochondria, Endoplasmic reticulum, Golgi body, Ribosomes, Peroxisomes and Vacuoles.

UNIT-II

Structure and function of Nucleus. Chromatin organization, concept of nucleosome. Structure and types of chromosomes: Special types of chromosome (Polytene and lampbrush). Chromosome aberrations: Structural aberrations- deletion, duplication, translocation, inversion. Numerical aberrations- aneuploidy and polyploidy. Cell cycle.-Mitosis, Meiosis. Linkage and crossing over.

UNIT-III

Laws of Mendelian inheritance, Mono and Dihybrid cross, test cross, back cross, Neomendelism: incomplete dominance, multiple alleles, complementary interaction, supplementary interaction, epistasis, duplicate gene, inhibitory genes, polygenic inheritance. Cytoplasmic inheritance in *Mirabilis jalapa*

UNIT-IV

Centres of origin of crop plants; Domestication, Introduction (Plant quarantine), Selection, Hybridization, Heterosis and Inbreeding depression Mutation breeding, breeding work done on wheat in India. Green Revolution

UNIT-V

Origin of life (Haldane/A.I. Oparin Hypothesis), Lamarck's theory, Darwin's theory, Mutation theory, Evidences of organic evolution, Natural selection, origin of species (allopatric and sympatric population, Isolating mechanism), Hardy-Weinberg principle.

B.Sc. II yr Syllabus (Annual Scheme)

PRACTICAL PAPER I (Paper Code : BOT 204)

(A) TAXONOMY

1. Poaceae : *Triticum*
2. Liliaceae : *Lily*
3. Ranunculaceae : *Ranunculus*
4. Brassicaceae : *Brassica*,
5. Malvaceae : *Hibiscus*,
6. Leguminosae : *Pisum, Bauhinia*,
- 7 Cucurbitaceae : *Citrullus*
8. Asteraceae : *Helianthus, Tridax, Ageratum*.
9. Apocynceae : *Catharanthus, Nerium, Thevetia*.
10. Solanaceae : *Petunia. Datura*

The above list of plants is only suggestive and can be replaced depending on local availability.

(B) ECONOMIC BOTANY

Cereals - rice, wheat and maize **Pulses** - green gram, chick pea, pigeon pea and soyabean. **Fibers** - cotton and jute. **Oils** - groundnut, mustard and coconut. **Timbers** - shisham, sal and teak. **Beverages** - tea and coffee. Sugarcane **Spices and Condiments** - turmeric, cumin, corriander, fennel, black pepper, clove, cardamom, asafoetida, saffron, cinnamon. **Medicinal plants** with special reference to Rajasthan- *Aloe, Commiphora, Withania, Rawolfia, Opium avd Abrus*.

(C) ANATOMY

1. Stem : *Boerhaavia, Achyranthes, Bignonia, Salvadoria, Chenopodium, Mirabilis, Leptadaenia, Nyctanthes, Dracaena, Bougenvellia* and *Triticum*
2. Root : *Tinospora, Ficus*.
3. Study of meristems through permanent slides and photographs.
4. Tissues (parenchyma, collenchyma and sclerenchyma); (temporary and permanent slides, photographs)

(D) EMBRYOLOGY SLIDES :

1. Placentation : Types
2. Ovules : Types
3. T.S. Anther
4. L.S. Mature seed: Maize/Gram/Pea
5. L.S. bud with anther and gynoecium.
6. Pollinium (whole mount).
7. Special types of inflorescence – verticillaster, cyathium, hypanthodium
8. Dissection of embryo/endosperm from monocot and dicot seeds.

(E) CYTOLOGY and GENETICS

Study of prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron microphotographs.

Study of the photomicrographs of ultra structure of cell organelles, Study the structure of nuclear pore complex by photograph.

Smear preparation of root tips and onion bud for different stages of mitosis and meiosis.

Study of special chromosomes (polytene & lampbrush) either by slides or photographs.

Monohybrid and Dihybrid ratio and their modifications

B.Sc. III yr Syllabus (Annual Scheme)

PAPER I (Paper Code : BOT 301) ECOLOGY, ENVIRONMENTAL BIOLOGY AND BIOSTATISTICS

UNIT-I

Definition and aims of ecological studies. Factors affecting plant growth and distribution - climatic, edaphic, biotic and topographic. Ecosystem concept - structure and function: food chain, food web, trophic levels, ecological pyramids, energy flow and biogeochemical cycles.(C,N,P,S).

UNIT-II

Plant population - natality, mortality, age and sex ratio, factors affecting population growth, growth curves. Plant Community - concept and characters (frequency, density, abundance, cover and basal area) phenograms, life forms, and biological spectrum. Plant succession- xerosere, hydrosere.

UNIT-III

Pollution : air, water, land, noise and radioactive; their control, green house effect, acid rain, ozone depletion, biomagnification and eutrophication. Conservation and management of natural resources, endangered plants of Rajasthan and their conservation; biosphere reserves, National Parks and Sanctuaries, Chipko movement.

UNIT-IV

Biodiversity and its Conservation. Mega diversity and Hot spots in India Morphological, Anatomical and Physiological adaptations of hydrophytes, xerophytes and halophytes; Plant indicators.

UNIT-V

Major biomes of the world with special reference to desert and grassland. Phytogeographical regions of India, endemism, continental drift theory, land bridges, migration. Biostatistics: Definition, Applications and merits and demerits- Mean (Arithmetic mean), Median (for grouped and ungrouped data), Mode, Standard deviation and chi square test.

B.Sc. III yr Syllabus (Annual Scheme)

PAPER II (Paper Code: BOT 302)

PLANT PHYSIOLOGY AND BIOCHEMISTRY

UNIT-I

Plant-water relations: diffusion and osmosis; DPD, turgor pressure, wall pressure, concept of water potential, ascent of sap, transpiration, mechanism of opening and closing of stomata and guttation. Mineral nutrition: role of macro- and micro-elements and their deficiency symptoms.

UNIT-II

Photosynthesis: photosynthetic pigments, photophosphorylation, light absorption and mechanism of CO₂ fixation in C₃ and C₄ plants. Brief account of CAM plants and photorespiration. Factors affecting photosynthesis.

UNIT-III

Respiration: Aerobic and anaerobic respiration; Glycolysis and Krebs cycle; electron transport mechanism, oxidative phosphorylation; pentose phosphate pathway.

UNIT-IV

Basics of enzymology: Discovery, nomenclature, classification and characteristics of enzymes; mechanism of action and enzyme kinetics. Brief account of biological nitrogen fixation. Lipid metabolism: Characteristics, biosynthesis, alpha and β-oxidation ; glyoxylate cycle.

UNIT-V

Plant growth regulators: Auxins, gibberellins, cytokinins, abscisic acid and ethylene. Discovery, physiological effects and their roles in agriculture and horticulture. Seed dormancy; photoperiodism and vernalization. Principle and applications of pH meter, centrifuge and chromatography.

B.Sc. III yr Syllabus (Annual Scheme)

PAPER III (Paper Code : BOT 303)

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

UNIT-I

DNA the genetic material: Structure and different forms of DNA; Replication of DNA. Central dogma, reverse transcription, genetic code and RNA processing(brief account).

UNIT-II

RNA: Types, Transcription and translation. RNA polymerases, Regulation of gene expression in prokaryotes (operon concept).

UNIT- III

Basics of recombinant DNA Technology: History and definition, Methods of genetic recombination in bacteria (Transformation, Transduction and Conjugation). restriction enzymes (types and their properties), Gene cloning vectors: types of vectors (pBR322, pUC, YAC). *Neurospora* genetics. *Agrobacterium*-mediated gene transfer in plants, Direct methods of gene transfer: electroporation, chemical methods, biolistics, microinjection, macro injection.

UNIT- IV

Basic techniques, tools and applications of plant tissue culture: Sterilization, explants, Culture media (MS), Methods of Micropropagation (Axillary bud proliferation, Adventitious shoot bud differentiation and somatic embryogenesis). Various stages of Micropropagation: establishment of cultures, Multiplication of In vitro established cultures, rooting (*In vitro* and *ex vitro*) and hardening of plantlets, Callus and Protoplast culture, Virus free plants Haploids, endosperm culture, Somaclonal variants, synthetic seeds. Cryopreservation

UNIT- V

Electrophoresis, DNA sequencing, DNA fingerprinting. PCR,. Blotting techniques, Secondary metabolites (Alkaloids) and Bioreactors, Protein profiling and its significance. Production of biodegradable plastics, GM Plants. IPR.

B.Sc. III yr Syllabus (Annual Scheme)

PRACTICALPAPER (Paper Code : BOT 304)

PAPER - I

A Plant adaptive modifications : Specimens / Slides.

1. Succulents : *Opuntia, Euphorbia*
2. Halophytes : *Tamrix/ Salsola*
3. Xerophytes : *Cocoloba, Parkinsonia, Acacia, Capparis,*
4. Hydrophytes : *Eichhornia, Hydrilla*

B Soil analysis

5. Soil texture
6. Soil moisture
7. Water holding capacity
8. Soil pH
9. Qualitative tests of nitrate, phosphate and carbonate.

C Water analysis

10. Hardness of water
11. Water temperature
12. Visibility of light in water column.
13. Carbonate, bicarbonate and chloride test.

D Ecological instruments

14. Maximum/minimum thermometer.
15. Hair hygrometer
16. Anemometer
17. Lux meter
18. pH meter

Field exercises

19. Determination of minimum size of a quadrat by species area curve method.
20. Determination of frequency, density and abundance of different species present in the community by quadrat method.

PAPER-II: PLANT PHYSIOLOGY AND BIOCHEMISTRY

1. Demonstration of colloidal systems: Suspension, Emulsion, Brownian movement.
2. To observe streaming movement of protoplasm (*Hydrilla*)
3. Perform of phenomenon of plasmolysis using *Rhoeo discolor* leaves.
4. Perform of phenomenon of osmosis by potato osmoscope.
5. Perform of opening and closing of stomata.
6. Calculation of stomatal index and stomatal frequency of mesophyte and Xerophytes.
7. Perform of unequal transpiration using cobalt chloride paper.
8. Perform of rate of transpiration using photometer(s).
9. Perform that oxygen is evolved during photosynthesis by inverted funnel method.
10. Effect of various wave-lengths of light on the process of photosynthesis.

11. Perform that light, CO₂ and chlorophyll are necessary for photosynthesis by Moll's half leaf Experiment.
12. Determine the value of respiratory quotient (RQ) of different respiratory substrates.
13. Separation of amino acids/plant pigments by paper chromatography.
14. Perform of activity of respiratory enzymes (Peroxidase, Catalase, Dehydrogenase) in plant tissues.
15. Introduction and demonstration of following instruments/ techniques : pH meter, centrifuge, colorimeter, chromatography.
16. Phytochemical tests of the following : starch, cellulose, sucrose, glucose/ fructose, proteins, fat, oxalic acid, malic acid, citric acid, tannins, ascorbic acid, anthocyanins.

PAPER - III
MOLECULAR BIOLOGY AND BIOTECHNOLOGY

- 1) Introduction to tools and techniques: Laminar flow bench, Autoclave and filter sterilization.
- 2) Preparation of culture media and solutions of nutrients and growth regulators.
- 3) Inoculation techniques: explant preparation and aseptic transfer.
- 4) Anther culture.
- 5) Preliminary exercise on isolation and culture of plant protoplasts.
- 6) Exercises for cloning of plants.
- 7) DNA isolation and gel electrophoresis.
- 8) Tests and separation of secondary metabolites.
- 9) Experiments on antibiotic resistance
- 10) Demonstration of Agarose gel electrophoresis.
- 11) Demonstration of molecular techniques: PCR and Blotting
- 12) Study through photographs: somatic embryogenesis, endosperm and embryo culture, protoplast isolation and culture and micropropagation